Q1 Cont'd

means for multiplexing coupled to means for oscillation and to the sensing elements, the means for multiplexing selecting a plurality of sensing elements, the electromagnetic field being generated using the means for oscillation and the selected sensing elements, the electromagnetic field being modulated to convey information to the object.

REMARKS

Information Disclosure Statement

An Information Disclosure Statement (IDS) is being filed concurrently herewith. Entry of the IDS is respectfully requested.

Claims 1-55 are pending in the application. Claims 1, 2, 3, 5, 31, 33, 34, and 41-43 stand rejected. In addition, the Office Action Summary lists Claims 17 and 38 as being rejected, but no grounds were supplied in the Detailed Action. The Applicant notes with appreciation that Claims 4, 6-16, 18-30, 32, 35-37, 39, 40, and 44-55 would be allowed if written in independent form.

Please note that the new Claims 57, 58, 59, and 60 are, respectively, Claims 4, 6, 16, and 41 rewritten in independent form.

The claimed invention generally comprises a variety of methods and devices using multiple sensing elements or antenna elements. Each of these elements has at least one characteristic frequency of electromagnetic oscillations occurring within the element; this characteristic frequency may be the resonant frequency. When an object is in proximity to a sensing element, this characteristic frequency may change. This change is caused by the electromagnetic coupling between the sensing element and the object via an electromagnetic field. This change may be measured. The change of characteristic frequency indicates if and how such coupling has occurred. By analyzing such changes for multiple sensing elements it is

possible to determine the position and orientation of the object. By selectively switching specific antenna elements, it is possible to communicate with external devices.

Regarding Rejections Based on Gilboa

Claims 1, 2, 3, 5, and 31 are rejected under 35 U.S.C. § 102(e) as being taught by U.S. Patent Application 2002/0062203 to Gilboa.

Gilboa discusses a method for determining the position of a movable object. The object is equipped with one or more magnetometers or with one or more coils and a device for measuring some parameters of the current within the coil or coils. In Gilboa, this arrangement for measuring magnetic field is generically called a sensor. The object is then positioned within a magnetic field generated by several static coils. This magnetic field causes different changes in the sensor depending on the object's position with respect to the static coils. These changes are used by a processor to obtain the current position of the moveable object.

This arrangement is illustrated in Gilboa's Fig. 6. The static coils 62, 64, 66, 68, 70 (driven by circuitry 60) are used to create the electromagnetic field, the sensor 52 produces some data, these data are transmitted from the object 10 and are received by the receiver 58, which in turn passes them to the processor 72 in the control unit 76 to calculate the position of the object 10.

Throughout Gilboa, it is stated that the magnetic filed generated by the coils is either static or "quasistatic", by which is meant a fixed frequency magnetic field (Gilboa, page 4, paragraph 39, lines 1-4). Gilboa does not mention or use any changes in characteristic frequency of elements or changes in frequency of an electromagnetic field in the course of operation.

Amended Claims 1 and 31 include limitations requiring measuring changes in the characteristic frequencies of the sensing elements.

The Office Action points to page 5, paragraph 0060, lines 13-18, and page 4, paragraphs 0048-0049, in Gilboa as referring to measuring changes in frequencies. The Applicant

respectfully disagrees. The signals being compared in Gilboa at these locations have the same frequencies, and no characteristic frequencies of any elements are being compared or measured anywhere in Gilboa.

Amended Claims 2, 3, and 5 are dependent on independent amended Claim 1, and therefore contain all the limitations of amended Claim 1. Because limitations of amended Claim 1 have been shown above to be absent from the teachings of Gilboa, either explicitly or impliedly, then each of the Claims 2, 3, and 5 are also not anticipated by Gilboa.

Therefore, for the above-stated reasons, the Applicant respectfully requests reconsideration of the rejections under 35 U.S.C. § 102(e).

Regarding Rejections Based on Arndt

Claims 31, 33, 34, 41, 42, and 43 are rejected under 35 U.S.C. § 102(b) as being taught by U.S. Patent 6,097,189 to Arndt et al.

Arndt discusses a method for locating a buried passive antenna by emitting fixed frequency electromagnetic waves and comparing the emitted signal with the signal received in response from the buried antenna. The differences between the signals for differently positioned buried antennas include the strength of the received signal, phase shift, and the directional pattern of the signal. Thus, these parameters are used to calculate the buried antenna's position. Arndt does not mention or use any changes in characteristic frequency of elements or changes in frequency of transmitted or received electromagnetic signals in the course of operation.

Amended Claim 31 includes as a limitation a measuring device for measuring changes in the characteristic frequencies of the sensing elements.

The Office Action points to line 6 in Arndt's abstract as referring to measuring changes in frequencies. The Applicant respectfully disagrees. Arndt at this location describes "measuring the phase thereof [of a signal] with respect to a reference signal." No characteristic frequencies of any elements are being compared anywhere in Arndt.

Amended Claims 33, 34, 41, 42, and 43 are dependent on independent amended Claim 31, and therefore contain all the limitations of amended Claim 31. Because limitations of amended Claim 31 have been shown above to be absent from the teachings of Arndt, either explicitly or impliedly, then each of the Claims 33, 34, 41, 42, and 43 are also not anticipated by Arndt.

Amended Claims 33 and 34 introduce as limitations, respectively, capacitive and inductive electromagnetic coupling of the sensing array to the movable object.

The Office Action points to column 10, lines 37-39, in Arndt as referring to an inductor and capacitor apparently equating their presence with the above mentioned capacitive and inductive electromagnetic coupling of the sensing array to the movable object. The Applicant respectfully disagrees. The inductor and capacitor mentioned by Arndt are neither part of the antenna used to receive the signal from the buried antenna nor of the buried antenna itself and are not determinative of the nature of coupling between the antennas.

Amended Claims 41-43 introduce as limitation, masking sensor elements to convey information to external devices.

The Office Action points to column 15, lines 57-61 in Arndt as referring to such masking. The Applicant respectfully disagrees. This location in Arndt describes changing electromagnetic parameters of a buried antenna to distinguish it from other buried antennas. In Arndt, the alterations are performed on buried antenna, i.e., on the object being located, while Claims 41-43 refer to altering of sensor elements, i.e., of the means for locating objects. Also, Arndt does not mention or imply possibility of using such alterations for external communications.

Therefore, for the above-stated reasons, the Applicant respectfully requests that the rejections under 35 U.S.C. § 102(b) be reconsidered.

CONCLUSION

In view of the above amendments and remarks, it is believed that all claims are in condition for allowance, and it is respectfully requested that the application be passed to issue. If the Examiner feels that a telephone conference would expedite prosecution of this case, the Examiner is invited to call the undersigned attorney at (978) 341-0036.

Respectfully submitted,

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MARKED UP VERSION OF AMENDMENTS

Claim Amendments Under 37 C.F.R. § 1.121(c)(1)(ii)

1. (Amended) [A method of determining the sensing a specified object with respect to a reference surface, said method comprising the steps of:

a) providing an array of near-field antenna elements in the form of electrode or coil structures, heretofore termed "sensing elements";

b) generating electromagnetic signals via DC or AC coupling to sensing elements having one or more characteristic frequencies of oscillation;

c) providing a means for measuring said characteristic frequencies

c) coupling the generated electromagnetic field to said object capacitively and/or inductively via one or more sensing elements; and

d) measuring changes in said characteristic frequencies that are caused by said object;]

<u>A method of probing an object, the method comprising:</u>

<u>forming a reference structure comprising near-field antenna sensing elements, each sensing element having one or more characteristic frequencies of oscillation;</u>

<u>generating an electromagnetic field near the sensing elements;</u>

<u>coupling electromagnetically at least one sensing element to the object via the electromagnetic field; and</u>

<u>measuring changes in the characteristic frequencies that are caused by the coupling.</u>

2. (Amended) [The method of Claim 2, wherein the measured changes in characteristic frequencies are used to determine the presence, identity, position, or orientation of said object;]

<u>The method of Claim 1 further comprising:</u>

<u>determining physical parameters of the object from the measured changes in the characteristic frequencies.</u>

3. (Amended) [The method of Claim 2, wherein the measured changes in characteristic frequencies are used to determine the presence of said object;]
The method of Claim 1 further comprising:
determining the presence of the object from the measured changes in the characteristic frequencies.

4. (Amended) [The method of Claim 2, wherein the measured changes in characteristic frequencies are used to determine the identity of said object having known material properties;]
The method of Claim 1 further comprising:
determining the identity of the object from the measured changes in the characteristic frequencies.

5. (Amended) [The method of Claim 2, wherein the measured changes in characteristic frequencies are used to determine the position of said object;]
The method of Claim 1 further comprising:
determining the position of the object from the measured changes in the characteristic frequencies.

6. (Amended) [The method of Claim 2, wherein the measured changes in characteristic frequencies are used to determine the 2-dimensional orientation of said object in the plane of the sensing surface;]
The method of Claim 1 further comprising:
determining the orientation of the object from the measured changes in the characteristic frequencies.

7. (Amended) [The method in Claim 2, wherein step d) is carried out with the aid of a frequency counter.]
The method of Claim 1 wherein measuring changes comprises using a frequency counter.

8. (Amended) [The method in Claim 2, wherein the coupling of said electromagnetic radiation to said object is capacitive in nature.]

The method of Claim 1 wherein the electromagnetic coupling is capacitive.

9. (Amended) [The method in Claim 2, wherein the coupling of said electromagnetic radiation to said object is inductive in nature.]

The method of Claim 1 wherein the electromagnetic coupling is inductive.

10. (Amended) [The method in Claim 8, further comprising the steps of:

providing for each antenna element, an oscillator coupled thereto;

providing a multiplexer coupled at its outputs to each oscillator; and

selecting via said multiplexer, an oscillator-antenna combination for transmitting said electromagnetic radiation.]

The method of Claim 8, further comprising:

coupling an oscillator to each sensing element;

coupling a multiplexer to the oscillators; and

selecting, by the multiplexer, a combination of an oscillator and a sensing element for generating the electromagnetic field.

11. (Amended) [The method in Claim 9, further comprising the steps of:

providing for each antenna element, an oscillator coupled thereto;

providing a multiplexer coupled at its outputs to each oscillator; and

selecting via said multiplexer, an oscillator-antenna combination for transmitting said electromagnetic radiation.]

The method of Claim 9, further comprising:

coupling an oscillator to each sensing element;

coupling a multiplexer to the oscillators; and

selecting, by the multiplexer, a combination of an oscillator and a sensing element for generating the electromagnetic field.

12. (Amended) [The method in Claim 8, further comprising the steps of:

providing an oscillator for carrying out step b);

providing a multiplexer coupled at its input to said oscillator, and coupled at its outputs to said antenna elements; and

selecting via said multiplexer, a antenna element for transmitting said electromagnetic radiation.]

The method of Claim 8, further comprising:

generating the electromagnetic field using an oscillator;

coupling a multiplexer to the oscillator and to the sensing elements; and

selecting, by the multiplexer, a sensing element for generating the electromagnetic field.

13. (Amended) [The method in Claim 9, further comprising the steps of:

providing an oscillator for carrying out step b);

providing a multiplexer coupled at its input to said oscillator, and coupled at its outputs to said antenna elements; and

selecting via said multiplexer, a antenna element for transmitting said electromagnetic radiation.]

The method of Claim 9, further comprising:

generating the electromagnetic field using an oscillator;

coupling a multiplexer to the oscillator and to the sensing elements; and

selecting, by the multiplexer, a sensing element for generating the electromagnetic field.

14. (Amended) [The method in Claim 8, further comprising the steps of:

providing at least a masking element for masking selected antenna elements; and

selectively masking the antenna elements so that the only the unmasked elements are responsive to electromagnetic coupling to the object being sensed.]

The method of Claim 8, further comprising:

selecting sensing elements for masking; and

selectively masking the selected sensing elements so that only the unmasked elements couple to the object.

15. (Amended) [The method in Claim 9, further comprising the steps of:

providing at least one masking element for the purpose of masking selected electrodes; and

selectively masking electrodes so that the only the unmasked electrodes are responsive to electromagnetic radiation received from said object.]

The method of Claim 9, further comprising:

selecting sensing elements for masking; and

selectively masking the selected sensing elements so that only the unmasked elements couple to the object.

16. (Amended) [The method in Claim 2, further comprising the steps of:

modulating transmitted electromagnetic radiation in a manner which can be used to convey information to one or more external electronic devices receptive to said electromagnetic radiation.]

A method of Claim 1, further comprising:

coupling a multiplexer to an oscillator and to the antenna elements;

selecting, by the multiplexer, a plurality of antenna elements; and

generating an electromagnetic field using the oscillator and the selected antenna elements, the electromagnetic field being modulated to convey information to the object.

17. (Amended) [The method in Claim 8, further comprising the steps of:

modulating transmitted electromagnetic radiation in a manner which can be used to convey information to one or more external electronic devices.]

A method of Claim 8, further comprising:

coupling a multiplexer to an oscillator and to the antenna elements;

selecting, by the multiplexer, a plurality of antenna elements; and

generating an electromagnetic field using the oscillator and the selected antenna elements, the electromagnetic field being modulated to convey information to the object.

18. (Amended) [The method in Claim 9, further comprising the steps of:

modulating transmitted electromagnetic radiation in a manner which can be used to convey information to one or more external electronic devices.]

A method of Claim 9, further comprising:

coupling a multiplexer to an oscillator and to the antenna elements;

selecting, by the multiplexer, a plurality of antenna elements; and

generating an electromagnetic field using the oscillator and the selected antenna elements, the electromagnetic field being modulated to convey information to the object.

19. (Amended) [The method in Claim 2, further comprising the steps of:

providing for said object, at least one or more electromagnetic markers comprised of material with electromagnetic properties (electrical conductivity, σ, magnetic permeability, μ, and dielectric constant, ε) appreciably different from that of the object;

wherein the electromagnetic material properties of the markers produce detectable frequency shifts in the sensing array, and the spatial pattern of the markers on or in the object enables identification of the object and enhances the derivation of position and orientation information about said object.]

The method of Claim 1, further comprising:

coupling at least one marker with the object, the at least one marker having electromagnetic properties substantially different from the electromagnetic properties of the object, the electromagnetic properties of the at least one marker causing the changes in the characteristic frequencies, the spatial arrangement of the at least one marker enhancing the probing of the object.

20. (Amended) [The method in Claim 8, further comprising the steps of:

providing for said object, at least one or more electromagnetic markers comprised of material with electromagnetic properties (electrical conductivity, σ, magnetic permeability, μ, and dielectric constant, ε) appreciably different from that of the object;

wherein the electromagnetic material properties of the markers produce detectable frequency shifts in the sensing array, and the spatial pattern of the markers on or in the object enables identification of the object and enhances the derivation of position and orientation information about said object.]

The method in Claim 8, further comprising:

coupling at least one marker with the object, the at least one marker having electromagnetic properties substantially different from the electromagnetic properties of the object, the electromagnetic properties of the at least one marker causing the changes in the characteristic frequencies, the spatial arrangement of the at least one marker enhancing the probing of the object.

21. (Amended) [The method in Claim 9, further comprising the steps of:

providing for said object, at least one or more electromagnetic markers comprised of material with electromagnetic properties (electrical conductivity, σ, magnetic permeability, μ, and dielectric constant, ε) appreciably different from that of the object;

wherein the electromagnetic material properties of the markers produce detectable frequency shifts in the sensing array, and the spatial pattern of the markers on or in the object enables identification of the object and enhances the derivation of position and orientation information about said object.]

The method in Claim 9, further comprising:

coupling at least one marker with the object, the at least one marker having electromagnetic properties substantially different from the electromagnetic properties of the object, the electromagnetic properties of the at least one marker causing the changes in the characteristic frequencies, the spatial arrangement of the at least one marker enhancing the probing of the object.

22. (Amended) [The method in Claim 2, further comprising the steps of:

providing for said object, at least one or more electromagnetic markers comprised of electrically conductive elements to be placed thereon;

wherein the electromagnetic material properties of the markers produce detectable frequency shifts in the sensing array, and the spatial pattern of the markers on or in the object enables identification of the object and enhances the derivation of position and orientation information about said object.]

The method of Claim 1, further comprising:

coupling at least one marker with the object, the at least one marker comprised of electrically conductive elements, the electromagnetic properties of the at least one marker causing the changes in the characteristic frequencies, the spatial arrangement of the at least one marker enhancing the probing of the object.

23. (Amended) [The method in Claim 8, further comprising the steps of:

providing for said object, at least one or more electromagnetic markers comprised of electrically conductive elements to be placed thereon;

wherein the electromagnetic material properties of the markers produce detectable frequency shifts in the sensing array, and the spatial pattern of the markers on or in the object enables identification of the object and enhances the derivation of position and orientation information about said object.]

The method in Claim 8, further comprising:

coupling at least one marker with the object, the at least one marker comprised of electrically conductive elements, the electromagnetic properties of the at least one marker causing the changes in the characteristic frequencies, the spatial arrangement of the at least one marker enhancing the probing of the object.

24. (Amended) [The method in Claim 9, further comprising the steps of:

providing for said object, at least one or more electromagnetic markers comprised of electrically conductive elements to be placed thereon;

wherein the electromagnetic material properties of the markers produce detectable frequency shifts in the sensing array, and the spatial pattern of the markers on or in the object

enables identification of the object and enhances the derivation of position and orientation information about said object.]

<u>The method in Claim 9, further comprising:</u>

<u>coupling at least one marker with the object, the at least one marker comprised of electrically conductive elements, the electromagnetic properties of the at least one marker causing the changes in the characteristic frequencies, the spatial arrangement of the at least one marker enhancing the probing of the object.</u>

25. (Amended) [The method in Claim 2, further comprising the steps of:

providing for said object, at least one or more electromagnetic markers comprised of magnetically permeable elements (defined as having $\mu >> 1$) to be placed thereon;

wherein the electromagnetic material properties of the markers produce detectable frequency shifts in the sensing array, and the spatial pattern of the markers on or in the object enables identification of the object and enhances the derivation of position and orientation information about said object.]

<u>The method of Claim 1, further comprising:</u>

<u>coupling at least one marker with the object, the at least one marker comprised of magnetically permeable elements, the electromagnetic properties of the at least one marker causing the changes in the characteristic frequencies, the spatial arrangement of the at least one marker enhancing the probing of the object.</u>

26. (Amended) [The method in Claim 8, further comprising the steps of:

providing for said object, at least one or more electromagnetic markers comprised of magnetically permeable elements (defined as having $\mu >> 1$) to be placed thereon;

wherein the electromagnetic material properties of the markers produce detectable frequency shifts in the sensing array, and the spatial pattern of the markers on or in the object enables identification of the object and enhances the derivation of position and orientation information about said object.]

<u>The method of Claim 8, further comprising:</u>

coupling at least one marker with the object, the at least one marker comprised of magnetically permeable elements, the electromagnetic properties of the at least one marker causing the changes in the characteristic frequencies, the spatial arrangement of the at least one marker enhancing the probing of the object.

27. (Amended) [The method in Claim 9, further comprising the steps of:

providing for said object, at least one or more electromagnetic markers comprised of magnetically permeable elements (defined as having $\mu>>1$) to be placed thereon;

wherein the electromagnetic material properties of the markers produce detectable frequency shifts in the sensing array, and the spatial pattern of the markers on or in the object enables identification of the object and enhances the derivation of position and orientation information about said object.]

The method of Claim 9, further comprising:

coupling at least one marker with the object, the at least one marker comprised of magnetically permeable elements, the electromagnetic properties of the at least one marker causing the changes in the characteristic frequencies, the spatial arrangement of the at least one marker enhancing the probing of the object.

28. (Amended) [The method in Claim 2, further comprising the steps of:

providing for said object, at least one or more electromagnetic markers comprised of material with a dielectric constant (ε) appreciably greater than the dielectric constant of the object;

wherein the electromagnetic material properties of the markers produce detectable frequency shifts in the sensing array, and the spatial pattern of the markers on or in the object enables identification of the object and enhances the derivation of position and orientation information about said object.]

The method of Claim 1, further comprising:

coupling at least one marker with the object, the at least one marker having a dielectric constant substantially greater than the dielectric constant of the object, the electromagnetic properties of the at least one marker causing the changes in the characteristic

frequencies, the spatial arrangement of the at least one marker enhancing the probing of the object.

29. (Amended) [The method in Claim 8, further comprising the steps of:

providing for said object, at least one or more electromagnetic markers comprised of material with a dielectric constant (ε) appreciably greater than the dielectric constant of the object;

wherein the electromagnetic material properties of the markers produce detectable frequency shifts in the sensing array, and the spatial pattern of the markers on or in the object enables identification of the object and enhances the derivation of position and orientation information about said object.]

The method of Claim 8, further comprising:

coupling at least one marker with the object, the at least one marker having a dielectric constant substantially greater than the dielectric constant of the object, the electromagnetic properties of the at least one marker causing the changes in the characteristic frequencies, the spatial arrangement of the at least one marker enhancing the probing of the object.

30. (Amended) [The method in Claim 9, further comprising the steps of:

providing for said object, at least one or more electromagnetic markers comprised of material with a dielectric constant (ε) appreciably greater than the dielectric constant of the object;

wherein the electromagnetic material properties of the markers produce detectable frequency shifts in the sensing array, and the spatial pattern of the markers on or in the object enables identification of the object and enhances the derivation of position and orientation information about said object.]

The method of Claim 9, further comprising:

coupling at least one marker with the object, the at least one marker having a dielectric constant substantially greater than the dielectric constant of the object, the electromagnetic properties of the at least one marker causing the changes in the characteristic

frequencies, the spatial arrangement of the at least one marker enhancing the probing of the object.

31. (Amended) [An apparatus for determining the position and orientation of a specified object with respect to a reference surface, said apparatus comprising:

a set of near-field antenna elements in the form of electrodes or coils;

a sensing array comprised of sensing elements;

at least one controlled oscillator that is DC or AC coupled to said sensing elements having one or more characteristic frequencies of oscillation; and

measuring circuitry coupled to said sensing array adapted to measure changes in one or more said characteristic frequencies;

wherein said electromagnetic radiation is coupled to said object, and the changes in one or more said characteristic frequencies is used to derive position or orientation of said object.]

An apparatus for probing an object, the apparatus comprising:

a reference structure having a plurality of near-field antenna sensing elements, each sensing element having one or more characteristic frequencies of oscillation;

an electromagnetic field, at least one sensing element being coupled electromagnetically to the object via the electromagnetic field; and

a measuring device measuring changes in the characteristic frequencies that are caused by the coupling.

32. (Amended) [The apparatus in Claim 31, wherein said measuring circuitry comprises a frequency counter.]

The apparatus of Claim 31 wherein the measuring device comprises a frequency counter.

33. (Amended) [The apparatus in Claim 31, wherein the coupling of said electromagnetic radiation to said object is capacitive in nature.]

The apparatus of Claim 31 wherein the coupling of the electromagnetic field to the object is capacitive.

34. (Amended) [The apparatus in Claim 31, wherein the coupling of said electromagnetic radiation to said object is inductive in nature.]

The apparatus of Claim 31 wherein the coupling of the electromagnetic field to the object is inductive.

35. (Amended) [The apparatus in Claim 33, further comprising:

a controlled oscillator for each antenna element; and

a multiplexer coupled at its outputs to each oscillator;

wherein said multiplexer is adapted to select an oscillator-antenna combination for transmitting said electromagnetic radiation.]

The apparatus of Claim 33, further comprising:

a plurality of oscillators, each oscillator being coupled to a respective sensing element; and

a multiplexer coupled to the oscillators, the multiplexer selecting a combination of an oscillator and a sensing element for generating the electromagnetic field.

36. (Amended) [The apparatus in Claim 34, further comprising:

a controlled oscillator for each antenna element; and

a multiplexer coupled at its outputs to each oscillator;

wherein said multiplexer is adapted to select an oscillator-antenna combination for transmitting said electromagnetic radiation.]

The apparatus of Claim 34, further comprising:

a plurality of oscillators, each oscillator being coupled to a respective sensing element; and

a multiplexer coupled to the oscillators, the multiplexer selecting a combination of an oscillator and a sensing element for generating the electromagnetic field.

37. (Amended) [The apparatus in Claim 33, further comprising:

a multiplexer coupled at its input to said oscillator, and coupled at its outputs to said antenna elements;

wherein said multiplexer is adapted to select a antenna element for transmitting said electromagnetic radiation.]

The apparatus of Claim 33, further comprising:

an oscillator; and

a multiplexer coupled to the oscillator and to the sensing elements, the multiplexer selecting a sensing element for generating the electromagnetic field using the oscillator.

38. (Amended) [The apparatus in Claim 34, further comprising:

a multiplexer coupled at its input to said oscillator, and coupled at its outputs to said antenna elements;

wherein said multiplexer is adapted to select a antenna element for transmitting said electromagnetic radiation.]

The apparatus of Claim 34, further comprising:

an oscillator; and

a multiplexer coupled to the oscillator and to the sensing elements, the multiplexer selecting a sensing element for generating the electromagnetic field using the oscillator.

39. (Amended) [The apparatus in Claim 33, further comprising:

at least a masking element adapted to mask selected electrodes;

wherein electrodes are selectively masked so that only the unmasked electrodes are responsive to electromagnetic radiation received from said object.]

The apparatus of Claim 33 wherein a plurality of the sensing elements are masked so that only the unmasked sensing elements couple to the object.

40. (Amended) [The apparatus in Claim 34, further comprising:

at least a masking element adapted to mask selected electrodes;

wherein electrodes are selectively masked so that only the unmasked electrodes are responsive to electromagnetic coupling to an object being sensed.]

The apparatus of Claim 34 wherein a plurality of the sensing elements are masked so that only the unmasked sensing elements couple to the object.

41. (Amended) [The apparatus in Claim 31, further comprising:

masking elements for modulating transmitted electromagnetic radiation in a manner which can be used to convey information to one or more external electronic devices receptive to said electromagnetic radiation.]

The apparatus of Claim 31, further comprising:

an oscillator; and

a multiplexer coupled to the oscillator and to the sensing elements, the multiplexer selecting a plurality of sensing elements, the electromagnetic field being generated using the oscillator and the selected sensing elements, the electromagnetic field being modulated to convey information to the object.

42. (Amended) [The apparatus in Claim 33, further comprising:

masking elements for modulating transmitted electromagnetic radiation in a manner which can be used to convey information to one or more external electronic devices receptive to said electromagnetic radiation.]

The apparatus of Claim 33, further comprising:

an oscillator; and

a multiplexer coupled to the oscillator and to the sensing elements, the multiplexer selecting a plurality of sensing elements, the electromagnetic field being generated using the oscillator and the selected sensing elements, the electromagnetic field being modulated to convey information to the object.

43. (Amended) [The apparatus in Claim 34, further comprising:

masking elements for modulating transmitted electromagnetic radiation in a manner which can be used to convey information to one or more external electronic devices receptive to said electromagnetic radiation.]

The apparatus of Claim 34, further comprising:

an oscillator; and

a multiplexer coupled to the oscillator and to the sensing elements, the multiplexer selecting a plurality of sensing elements, the electromagnetic field being generated using the oscillator and the selected sensing elements, the electromagnetic field being modulated to convey information to the object.

44. (Amended) [The apparatus in Claim 31, further comprising:

for said object, at least one or more electromagnetic markers comprised of electrically conductive elements to be placed thereon;

wherein the electromagnetic material properties of the markers produce detectable frequency shifts in the sensing array, and the spatial pattern of the markers on or in the object enables identification of the object and enhances the derivation of position and orientation information about said object.]

The apparatus of Claim 31, further comprising:

at least one marker comprised of electrically conductive elements, the at least one marker coupled to the object, the electromagnetic properties of the at least one marker causing the changes in the characteristic frequencies, the spatial arrangement of the at least one marker enhancing the probing of the object.

45. (Amended) [The apparatus in Claim 33, further comprising:

for said object, at least one or more electromagnetic markers comprised of electrically conductive elements to be placed thereon;

wherein the electromagnetic material properties of the markers produce detectable frequency shifts in the sensing array, and the spatial pattern of the markers on or in the object enables identification of the object and enhances the derivation of position and orientation information about said object.]

The apparatus of Claim 33, further comprising:

at least one marker comprised of electrically conductive elements, the at least one marker coupled to the object, the electromagnetic properties of the at least one marker

causing the changes in the characteristic frequencies, the spatial arrangement of the at least one marker enhancing the probing of the object.

46. (Amended) [The apparatus in Claim 34, further comprising:

for said object, at least one or more electromagnetic markers comprised of electrically conductive elements to be placed thereon;

wherein the electromagnetic material properties of the markers produce detectable frequency shifts in the sensing array, and the spatial pattern of the markers on or in the object enables identification of the object and enhances the derivation of position and orientation information about said object.]

The apparatus of Claim 34, further comprising:

at least one marker comprised of electrically conductive elements, the at least one marker coupled to the object, the electromagnetic properties of the at least one marker causing the changes in the characteristic frequencies, the spatial arrangement of the at least one marker enhancing the probing of the object.

47. (Amended) [The apparatus in Claim 31, further comprising:

for said object, at least one or more electromagnetic markers comprised of material with electromagnetic properties (electrical conductivity, σ, magnetic permeability, μ, and dielectric constant, ε) appreciably different from that of the object;

wherein the electromagnetic material properties of the markers produce detectable frequency shifts in the sensing array, and the spatial pattern of the markers on or in the object enables identification of the object and enhances the derivation of position and orientation information about said object.]

The apparatus of Claim 31, further comprising:

at least one marker having electromagnetic properties substantially different from the electromagnetic properties of the object, the at least one marker coupled to the object, the electromagnetic properties of the at least one marker causing the changes in the characteristic frequencies, the spatial arrangement of the at least one marker enhancing the probing of the object.

48. (Amended) [The apparatus in Claim 33, further comprising:

for said object, at least one or more electromagnetic markers comprised of material with electromagnetic properties (electrical conductivity, σ, magnetic permeability, μ, and dielectric constant, ε) appreciably different from that of the object;

wherein the electromagnetic material properties of the markers produce detectable frequency shifts in the sensing array, and the spatial pattern of the markers on or in the object enables identification of the object and enhances the derivation of position and orientation information about said object.]

<u>The apparatus of Claim 33, further comprising:</u>

<u>at least one marker having electromagnetic properties substantially different from the electromagnetic properties of the object, the at least one marker coupled to the object, the electromagnetic properties of the at least one marker causing the changes in the characteristic frequencies, the spatial arrangement of the at least one marker enhancing the probing of the object.</u>

49. (Amended) [The apparatus in Claim 34, further comprising:

for said object, at least one or more electromagnetic markers comprised of material with electromagnetic properties (electrical conductivity, σ, magnetic permeability, μ, and dielectric constant, ε) appreciably different from that of the object;

wherein the electromagnetic material properties of the markers produce detectable frequency shifts in the sensing array, and the spatial pattern of the markers on or in the object enables identification of the object and enhances the derivation of position and orientation information about said object.]

<u>The apparatus of Claim 34, further comprising:</u>

<u>at least one marker having electromagnetic properties substantially different from the electromagnetic properties of the object, the at least one marker coupled to the object, the electromagnetic properties of the at least one marker causing the changes in the characteristic frequencies, the spatial arrangement of the at least one marker enhancing the probing of the object.</u>

50. (Amended) [The apparatus in Claim 31, further comprising:

for said object, at least one or more electromagnetic markers comprised of magnetically permeable elements (defined as having μ>>1) to be placed thereon;

wherein the electromagnetic material properties of the markers produce detectable frequency shifts in the sensing array, and the spatial pattern of the markers on or in the object enables identification of the object and enhances the derivation of position and orientation information about said object.]

The apparatus in Claim 31, further comprising:

at least one marker comprised of magnetically permeable elements, the at least one marker coupled to the object, the electromagnetic properties of the at least one marker causing the changes in the characteristic frequencies, the spatial arrangement of the at least one marker enhancing the probing of the object.

51. (Amended) [The apparatus in Claim 33, further comprising:

for said object, at least one or more electromagnetic markers comprised of magnetically permeable elements (defined as having μ>>1) to be placed thereon;

wherein the electromagnetic material properties of the markers produce detectable frequency shifts in the sensing array, and the spatial pattern of the markers on or in the object enables identification of the object and enhances the derivation of position and orientation information about said object.]

The apparatus of Claim 33, further comprising:

at least one marker comprised of magnetically permeable elements, the at least one marker coupled to the object, the electromagnetic properties of the at least one marker causing the changes in the characteristic frequencies, the spatial arrangement of the at least one marker enhancing the probing of the object.

52. (Amended) [The apparatus in Claim 34, further comprising:

for said object, at least one or more electromagnetic markers comprised of magnetically permeable elements (defined as having μ>>1) to be placed thereon;

wherein the electromagnetic material properties of the markers produce detectable frequency shifts in the sensing array, and the spatial pattern of the markers on or in the object enables identification of the object and enhances the derivation of position and orientation information about said object.]

<u>The apparatus of Claim 34, further comprising:</u>

<u>at least one marker comprised of magnetically permeable elements, the at least one marker coupled to the object, the electromagnetic properties of the at least one marker causing the changes in the characteristic frequencies, the spatial arrangement of the at least one marker enhancing the probing of the object.</u>

53. (Amended) [The apparatus in Claim 31, further comprising:

for said object, at least one or more electromagnetic markers comprised of material with a dielectric constant (ε) appreciably greater than the dielectric constant of the object;

wherein the electromagnetic material properties of the markers produce detectable frequency shifts in the sensing array, and the spatial pattern of the markers on or in the object enables identification of the object and enhances the derivation of position and orientation information about said object.]

<u>The apparatus of Claim 31, further comprising:</u>

<u>at least one marker having a dielectric constant substantially greater than the dielectric constant of the object, the at least one marker coupled to the object, the electromagnetic properties of the at least one marker causing the changes in the characteristic frequencies, the spatial arrangement of the at least one marker enhancing the probing of the object.</u>

54. (Amended) [The apparatus in Claim 33, further comprising:

for said object, at least one or more electromagnetic markers comprised of material with a dielectric constant (ε) appreciably greater than the dielectric constant of the object;

wherein the electromagnetic material properties of the markers produce detectable frequency shifts in the sensing array, and the spatial pattern of the markers on or in the object enables identification of the object and enhances the derivation of position and orientation information about said object.]

The apparatus of Claim 33, further comprising:

at least one marker having a dielectric constant substantially greater than the dielectric constant of the object, the at least one marker coupled to the object, the electromagnetic properties of the at least one marker causing the changes in the characteristic frequencies, the spatial arrangement of the at least one marker enhancing the probing of the object.

55. (Amended) [The apparatus in Claim 34, further comprising:

for said object, at least one or more electromagnetic markers comprised of material with a dielectric constant (ε) appreciably greater than the dielectric constant of the object;

wherein the electromagnetic material properties of the markers produce detectable frequency shifts in the sensing array, and the spatial pattern of the markers on or in the object enables identification of the object and enhances the derivation of position and orientation information about said object.]

The apparatus of Claim 34, further comprising:

at least one marker having a dielectric constant substantially greater than the dielectric constant of the object, the at least one marker coupled to the object, the electromagnetic properties of the at least one marker causing the changes in the characteristic frequencies, the spatial arrangement of the at least one marker enhancing the probing of the object.